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GB 2207792 A EP 0317181 A2 WO 87/06381 A1
US 4357593 A

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INT CL[5] G08G

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(54) Infra-red route and hazard system

(57) An infra-red route and hazard system, comprises a transmitter unit (10), which continuously transmits an infra-red message (12), that contains general information eg. the road number, location along the road, speed restrictions etc. that can be used for route purposes, and information relating to hazards eg. bridge heights and widths, school crossings etc. including distance to the hazard, that can be used to give advance warnings; and a portable receiver detector (20), which is fixed to the vehicle body so as to be exposed to the infra-red transmitted signal and is also coupled to a microprocessor controlled receiver unit (22), which is mounted in view of the vehicle driver, and has the means to decode and display the message concerning the location of the transmitter and hazards being approached.

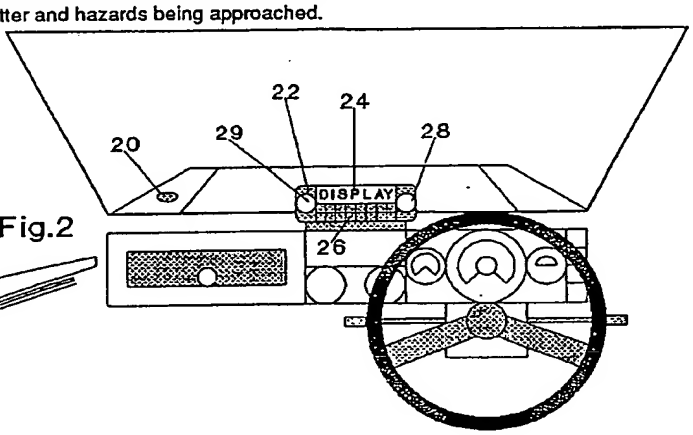

Fig.2

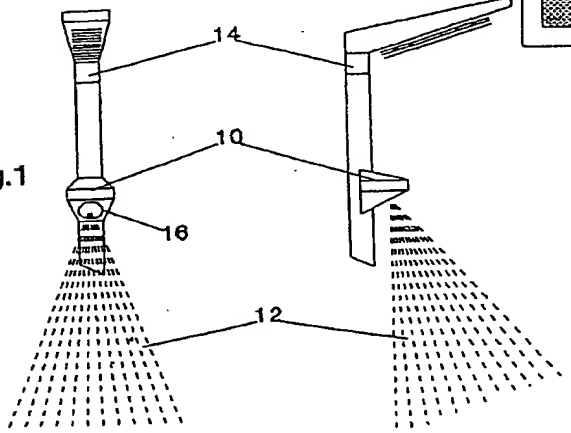

Fig.1

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Fig.1

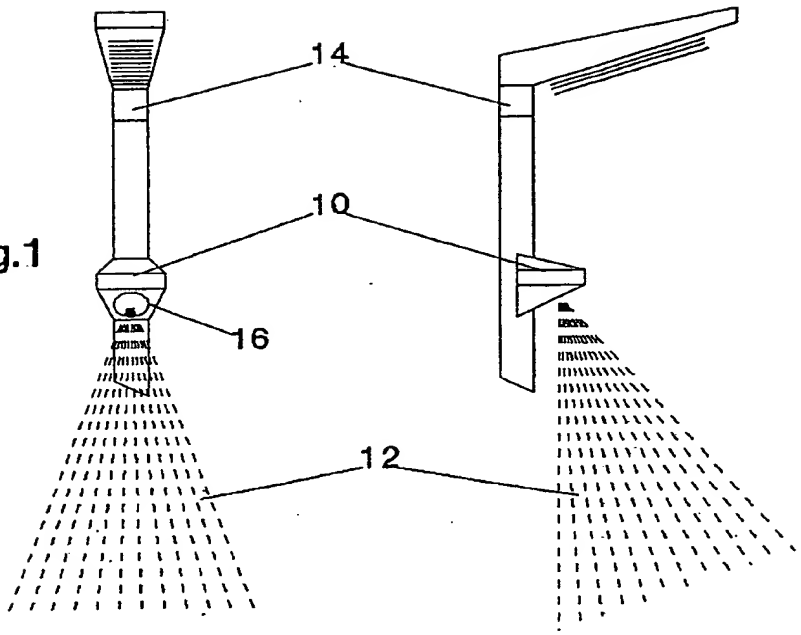


Fig.2

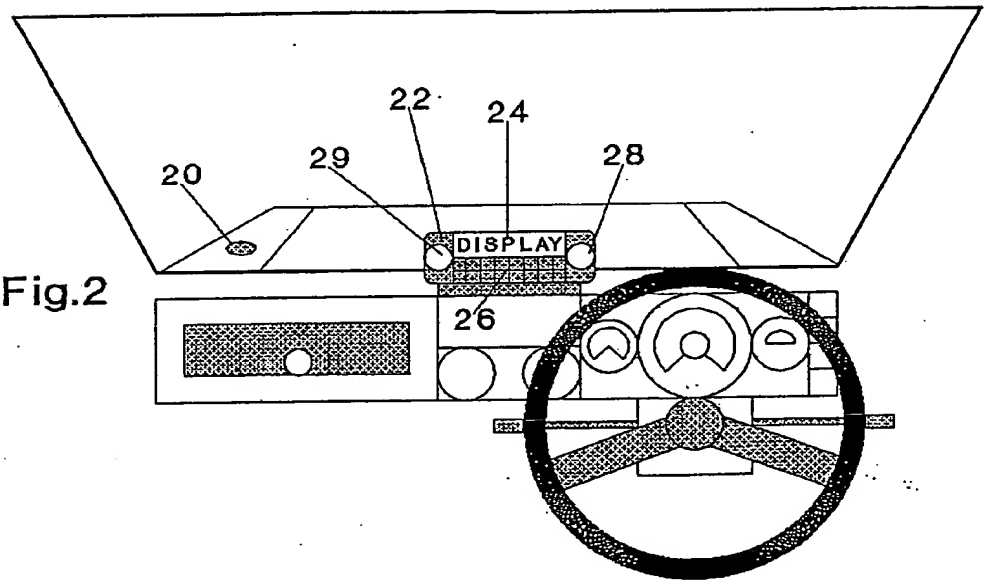


Fig.3

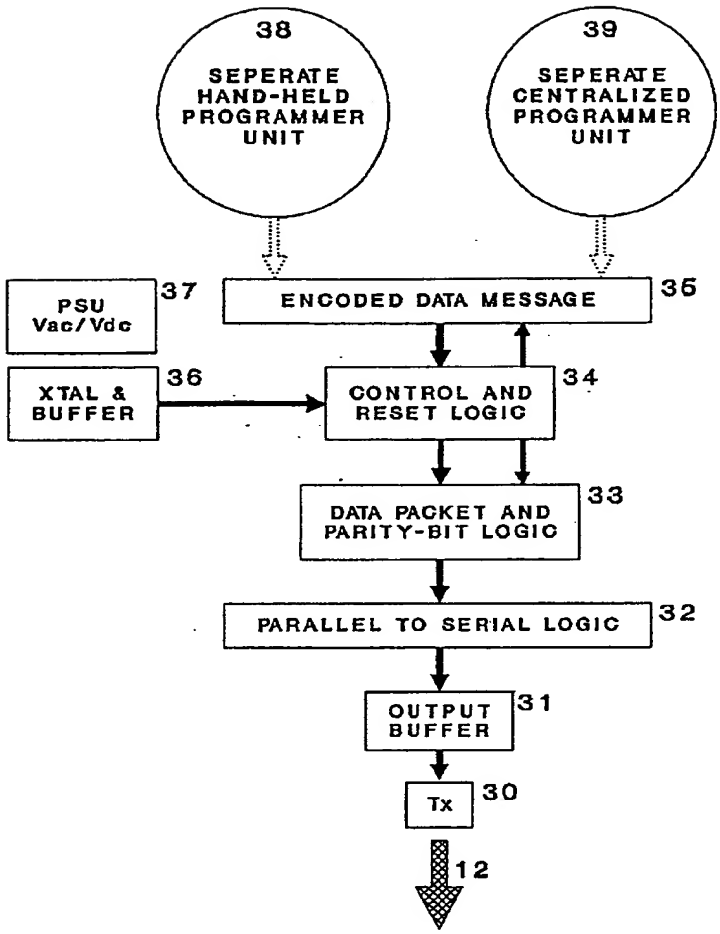

38
SEPERATE HAND-HELD PROGRAMMER UNIT
39
SEPERATE CENTRALIZED PROGRAMMER UNIT
PSU Vac/Vdc
37
ENCODED DATA MESSAGE
35
XTAL & BUFFER
36
CONTROL AND RESET LOGIC
34
DATA PACKET AND PARITY-BIT LOGIC
33
PARALLEL TO SERIAL LOGIC
32
OUTPUT BUFFER
31
Tx
30
12

Fig.4

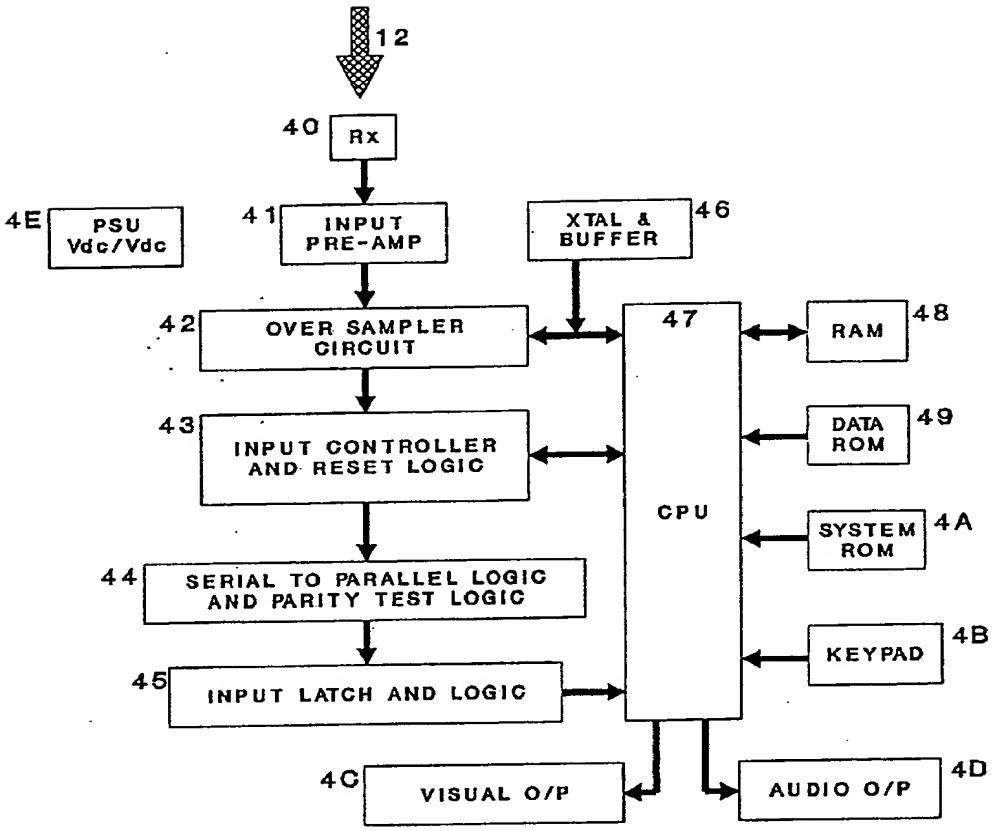
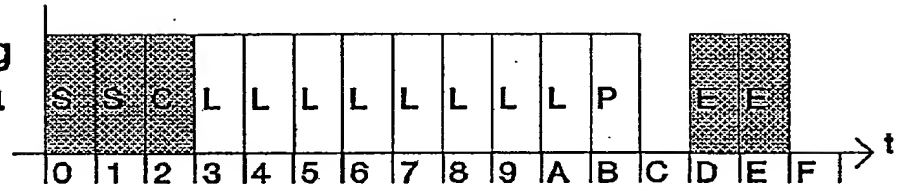

12
40
Rx
4E
PSU
Vdc/Vdc
41
INPUT
PRE-AMP
XTAL &
BUFFER
46
42
OVER SAMPLER
CIRCUIT
47
48
RAM
43
INPUT CONTROLLER
AND RESET LOGIC
DATA
ROM
49
CPU
SYSTEM
ROM
4A
44
SERIAL TO PARALLEL LOGIC
AND PARITY TEST LOGIC
KEYPAD
4B
45
INPUT LATCH AND LOGIC
4C
VISUAL O/P
AUDIO O/P
4D

Fig.5

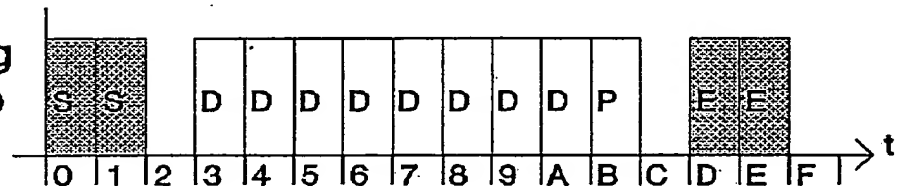
DATA PACKET TIMINGS

Fig 5a



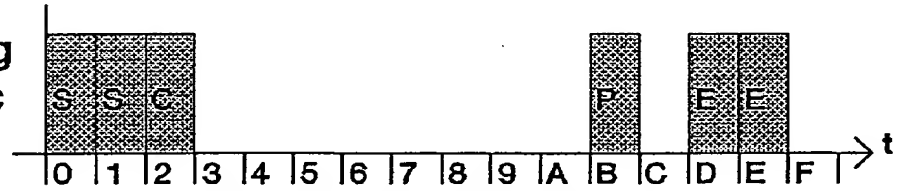
START OF MESSAGE PACKET

Fig 5b



MESSAGE DATA BYTE PACKET

Fig 5c



END OF MESSAGE PACKET

Fig.6

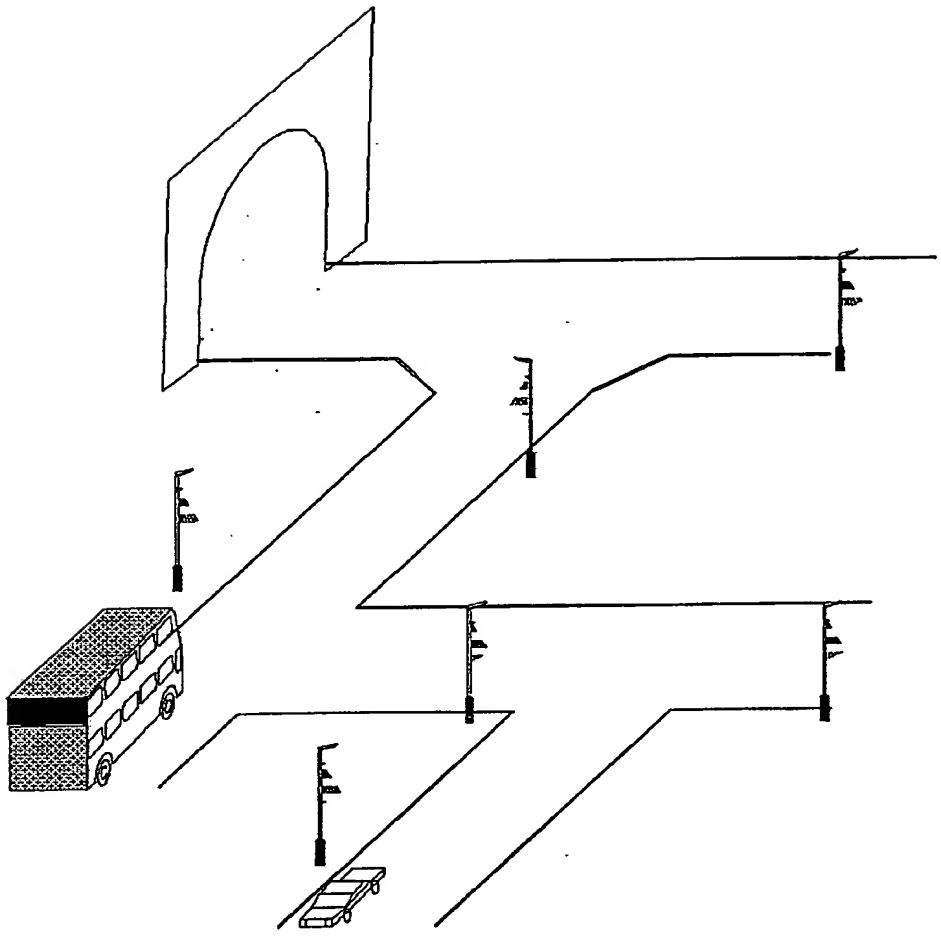


Fig.7

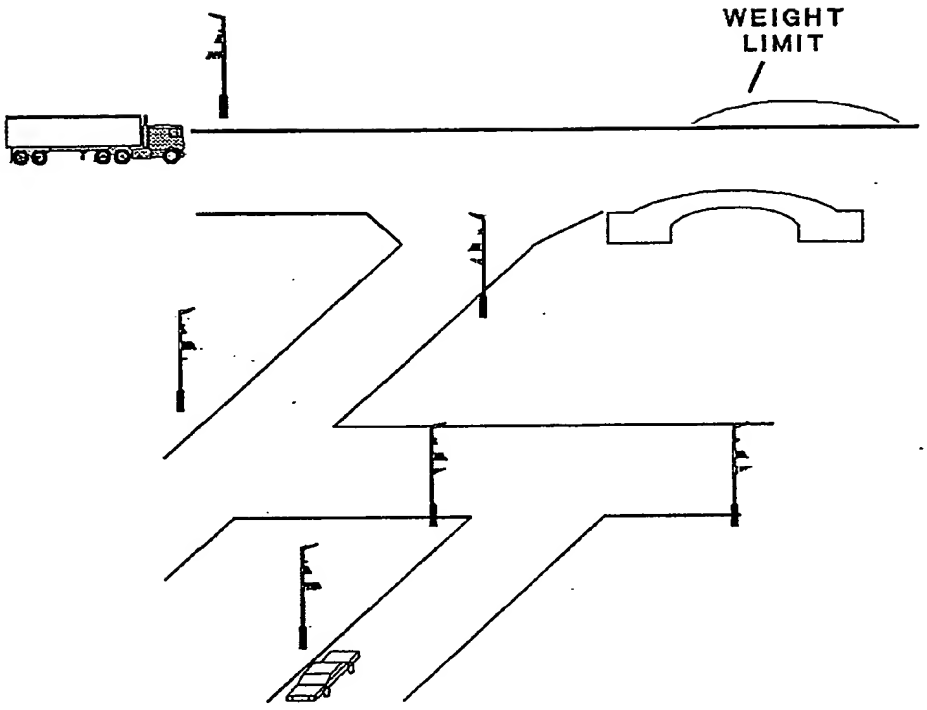


Fig.8

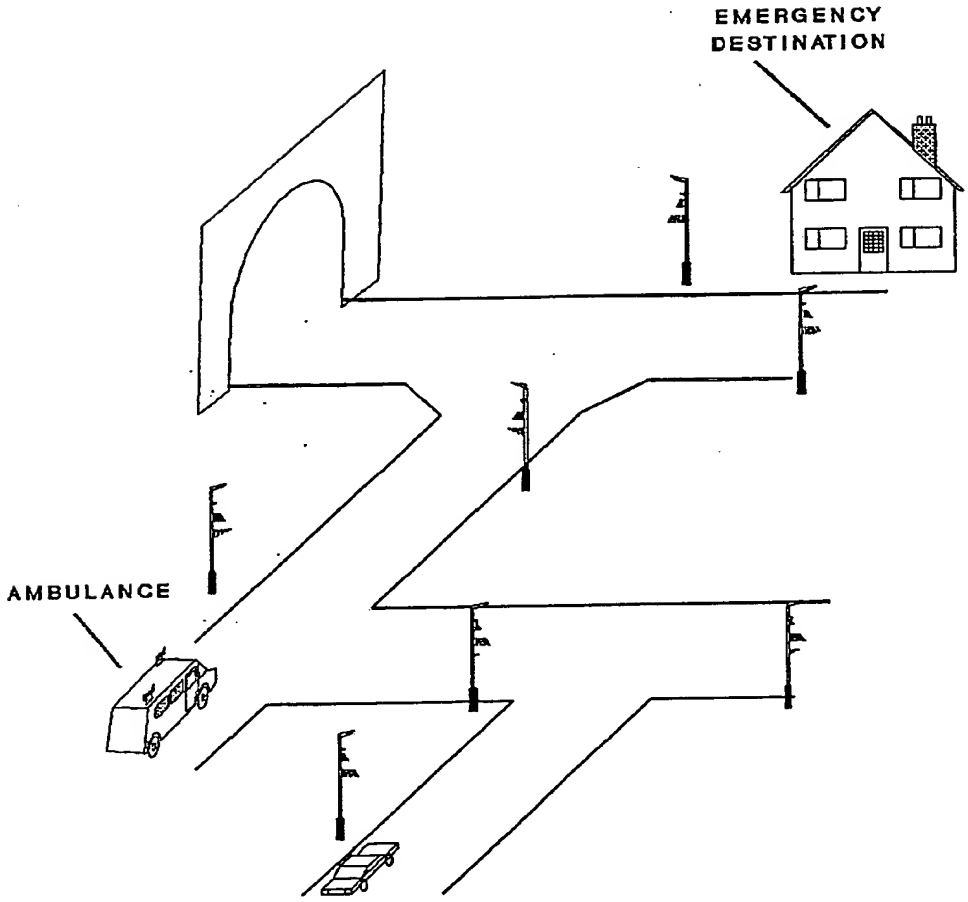
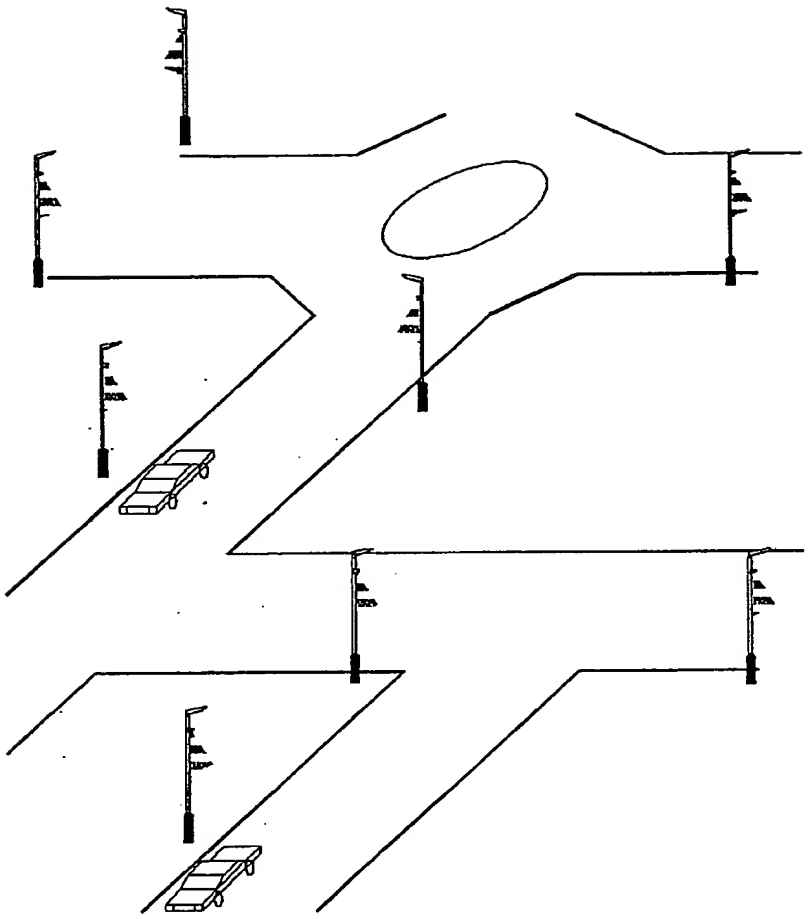


Fig.9



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INFRA-RED ROUTE & HAZARD SYSTEM

This invention relates to an infra-red transmitted data system, for motor vehicles on the public highways.

Infra-red systems are commonly used for non-contact transmission of limited amounts of data in domestic and industrial areas, where the transmitters are usually hand-held and portable, while the receiver is usually fixed in a non-moving piece of equipment, such systems are generally used as (remote) controllers rather than for true transmission of information. Thus, in these applications, the transmitted data is usually generated by a custom integrated circuit, in a simple form of encoded data packet, and will convey which button of a possible thirty-two buttons has been pressed on the transmitter, and the receiver will not generally perform an error-check of the received data.

The invented system described herein was designed to warn motor vehicle drivers of approaching hazards such as low bridges, schools and zebra crossings etc and also inform the driver of the road number, speed restriction and also indicate the location along the road, with the intention of simplifying and reducing the time to find a particular destination, for deliveries of goods etc.

The Infra-Red Route & Hazard System invention, comprises of the generally fixed transmitter unit, mounted and secured above and possibly although not essentially to the side of the traffic, typically but not exclusively on a lighting pole, and containing the electronics to accept, store, and transmit by infra-red means, a variable length binary coded message, such that can be received by the portable receiver unit mounted on a motor vehicle passing below the transmitter, and which contains the electronics to decode, error-check and display the transmitted message in an easily readable and spoken English form, with the purpose of providing the vehicle driver with relevant information about his/her location, and also providing advance warnings, about approaching hazards, and also providing a visual and audio alarm to alert the driver in the case of a severe hazard such as double-decker bus approaching a low-bridge.

The invention will now be described, along with examples of applications, with reference to the accompanying drawings, in which;

Figure 1 illustrates a typical transmitter attached to a street light;

Figure 2 illustrates a typical receiver fitted to a motor vehicle dash-board;

Figure 3 describes the electronics of the system transmitter, in functional block form;

Figure 4 describes the electronics of the system receiver, in functional block form;

Figure 5 describes the transmitted infra-red data packets that combine to construct the transmitted infra-red data message.

Figure 6 illustrates an example application of the system, in warning a double-decker bus driver of an approaching low-bridge;

Figure 7 illustrates an example application of the system in warning a heavy-goods vehicle driver of an approaching bridge with a weight limit;

Figure 8 illustrates an example application of the system in providing an ambulance driver with a route indication and the proximity to caller indication.

Figure 9 illustrates an example application of the system in providing motor car drivers with a location and route direction information.

Referring to the drawings, the system comprises of a fixed transmitter unit (10), which is secured by a means not shown, to typically but not exclusively a street light (14), at sufficient height to allow the transmitted infra-red beam (12), to be exposed to the infra-red receiver device (20), which is situated on an upper surface (roof, boot or bonnet) of the external bodywork of the vehicle, and which is connected by some means to the receiver unit (22), that will generally be mounted on or in the vehicle dashboard such that it is visible to the vehicle driver.

Referring to Figure 1, the transmitter unit (10), is attached to the supporting street light (14), and is sealed from the ingress of moisture by a means that is not shown, but includes a specially moulded cover, with an integral infra-red transparent window-lens (16).

The transmitter unit (10) will be connected to the electrical mains of the supporting structure for it's power, and the transmitter unit (10) will maintain the transmission of the data in the event of power failure, by means of a rechargeable battery-back-up, not shown, but included within the transmitter unit (10).

The transmitter unit (10) has the means to continuously transmit a pre-programmed variable-length data message, in the form of infra-red pulses (12). The transmitted message can contain any information programmed into the transmitter, and will generally but not exclusively be of two information types;

The message will contain general information:-

* The length of the data message (used by the receiver).
* The road-type and road-number eg.M4,A48,B4232.
* The speed-limit eg.30mph,60mph,70mph.
* The transmitter-number eg.lamp-number 3456 (for a more precise location along the road).
* Special routing information for specific users eg. bus routes and numbers.

The message will also contain relevant hazard information:-

* The hazard-type eg. LOW-BRIDGE, WEIGHT-LIMIT, JUNCTION, ROUNDABOUT, ZEBRA CROSSING, SCHOOL etc.
* The hazard-distance eg.1/4mile:400metres etc.
* Detailed hazard information eg.bridge-height, safe-weight limit, roundabout exit information etc.

Referring to Figure 2, the receiver detector (20), is secured to an un-specified upper facing exterior surface of the vehicle, by some mechanical means such as for example, but not limited to, a hole similar in size and placement as to that one usually used for a vehicle radio aerial, and such that the detector is visible to the transmitted infra-red beam. The infra-red detector (20) will be electronically connected by a means such as, but not exclusively, a screened multi-core cable, to the receiver unit (22).

The microprocessor controlled receiver unit (22), has the means and facility to be programmed with the vehicle-data (eg. height, width, weight) by the vehicle driver when the unit is initially installed in the vehicle using the attached keypad (26). The receiver unit (22), has the means of allowing the vehicle-data to be up-dated if required by the vehicle driver eg.at the start of each journey, the vehicle's size, weight and other relevant information, can be up-dated to make the receiver unit (22) aware of the vehicle-particular hazard conditions relating to the vehicle weight, height, route etc. that may change in heavy goods vehicles at each journey or sub-journey.

The receiver unit (22), has the electronic hardware and firmware means, to receive, decode and error-check the transmitted infra-red message (12), whilst the vehicle passes below the transmitter (10). The receiver has the means to compare the received data, and the vehicle-data entered by the vehicle driver either initially or upon starting the journey or sub-journey, and stored within the memory of the receiver unit (22). The receiver unit (22) has the means to visually display (24), the received information on for example, but not limited to, a Liquid Crystal Display, and also provide that same information in spoken English form. The receiver unit (22) also has the means to alert the vehicle driver to any vehicle-particular or severe hazards by a visual alarm (28), and audio alarm (29). The receiver unit also has the means to make the hazard warning persist until reset by the driver, using the means provided. The severe-hazard alarm will be re-triggered by the receiver unit (22), every time that it receives the same hazard information eg. the driver will continue to be alerted to the special-hazard, each time he/she passes beneath a transmitter unit (10) that sends the same hazard information, either until the hazard is passed, or the driver stops the vehicle, or turns the vehicle around, or turns the vehicle off the road that contains the special-hazard.

Referring to Figure 3, which describes the electronics of the transmitter unit (10), in a block diagram form, the description of each of the functional blocks is given;

The SEPARATE CENTRALIZED PROGRAMMER UNIT (39), is a SEPARATE unit used for communicating to transmitter units that form a network, which can have their transmitted messages updated by a operator who may be situated in the centralized control room of a motorway or police headquarters etc.
This unit is not described further in this document.

The SEPARATE HAND-HELD PROGRAMMER UNIT (38), is a SEPARATE unit used for programming or re-programming transmitter units with the transmitted messages, by a operator who will need to make a local connection by some means, to the transmitter unit.
This unit is not described further in this document.

The PSU Block (37), contains the means for connection to the electrical mains supply of the supporting structure, and includes a AC-voltage to DC-voltage converter, with a means for regulating the DC-voltage at the required voltage for the transmitter. It also contains the means for battery back-up of the regulated DC-voltage supply,

The CONTROL AND RESET LOGIC Block (34), contains the means for providing the system level control of the transmitter, and also provides the system synchronization by means of the crystal oscillator block (36), for the operation of the transmitter.

The DATA PACKET AND PARITY-BIT LOGIC Block (33), contains the means for accepting a byte of the data message (35), and constructing the appropriate multi-bit data packet with the inclusion of a parity bit.

The PARALLEL-TO-SERIAL LOGIC Block (32), contains the means of, accepting (in whole or part) the data message packet in parallel form and of then performing the parallel-to-serial operation of shifting one digital bit of the data packet, at a time into the output buffer block (31).

The OUTPUT BUFFER Block (31), contains the means for accepting the digital data packet output signal from the parallel-to-serial block (32), and providing an amplified signal to the infra-red transmitting device(s) in the Tx Block (30).

The Tx Block (30), contains the means for generating the high-output infra-red signal (12) that corresponds to the digital data packet. This is provided by at least one infra-red light emitting diode.

Referring to Figure 4, which describes the electronics of the receiver unit 10, in a block diagram form, the description of each of the functional blocks is given;

The Rx Block (40), contains the means for receiving infra-red radiation, and according to the intensity of that radiation, generates a corresponding electronic response, by means of at least one infra-red photodiode or phototransistor.

The INPUT PRE-AMP Block (41), contains the means for providing amplification and filtering of the incoming signal, before passing the incoming signal, to the over-sampler and check-bit logic (42).

The OVER-SAMPLER LOGIC Block (42), contains the means of performing the asynchronous decoding by applying an over-sampled decoder running at a higher frequency, than the transmitted infra-red pulse frequency. It ensures correct reception of each digital data bit of the transmitted data packet of the message.

The INPUT CONTROLLER AND RESET LOGIC Block (43), contains the means to provide sub-system level control of the incoming message reception, decoding and error-checking. It also contains the means for providing system level synchronization and reset.

The SERIAL-TO-PARALLEL AND PARITY Block (44), contains the means for accepting and validating each data packet, and it also has the means for providing the received data packet in whole or part, in parallel form, for the input latch logic (45).

The INPUT LATCH Block (45), contains the means for accepting and storing the digitally encoded data packet (in whole or part), from the serial-to-parallel block (44). It also contains the means for providing a data-ready-flag that the microprocessor (47) can poll periodically according to the hardware and firmware of the receiver unit (22), to determine that a new data packet has been received and is available to be read.

The XTAL & BUFFER Block (46), contains the means for generating the high-stability and symmetric oscillator frequencies, required by the over-sampler logic block (42), for the correct reception and decoding of the infra-red data packets. It also provides the high-stability clock frequency for the CPU block (47).

The CPU Block (47), contains the microprocessor such as but not exclusively the Zilog Z80, and the associated address decoding and control circuits. It provides the means for embedded control of the operation of the receiver unit (22), in conjunction with the system firmware, software and operating data.

The RAM Block (48), contains the means for and provides the temporary and semi-permanent storage of the processor variables, external stack and operating data loaded by the system user, in for example but not exclusively in a static-ram integrated circuit.

The DATA ROM Block (49), contains the means, such as but not exclusively a plug-in cartridge, that when fitted into an appropriate slot in the receiver unit (22), provides the appropriate route information in the case of a repetitive route, for example but not exclusively a bus route, which the microprocessor can compare with the received infra-red messages, to inform the driver that he should for example take the next-left-turn, or inform him that he has deviated from the required route.

The SYSTEM ROM Block (4A), contains the means for providing a permanent storage for the receiver unit operating program.

The KEYPAD Block (4B), provides the means for the user of the system to for example but not exclusively, enter his or her individual vehicle particulars such as the vehicle height and weight, that the microprocessor will use in determining that a vehicle particular hazard eg. a low bridge, is being approached and must be alarmed to the vehicle driver.

The VISUAL OUTPUT Block (4C), contains the means for providing the vehicle driver with the information that the received message contains, in an easily and quickly readable form such as, but not exclusively, a liquid crystal display with illumination. It also contains the means for providing a separate visual alarm indicator in the case of a severe hazard condition such as a double-decker bus approaching a low-bridge.

The AUDIO OUTPUT Block (4D), contains the means for providing the vehicle driver with a distinct and audible alarm warning, in the case of a severe hazard condition such as a double-decker bus approaching a low-bridge. It also contains the means for providing all the visually displayed information in spoken English form, which will allow the driver to listen to route information without taking his/her eyes from the road ahead, if so desired.

The PSU Block (4E), contains the means for connection to the electrical supply of the vehicle, and also the means for DC-voltage conversion and regulation to the required voltage for the receiver unit electronics.

Referring to Figure 5, which describes the different types of infra-red data packets (12), in timing diagram form, the description of each of the data packet types is given;

Each data packet consists of fifteen bits of digital infra-red information; The (S) bits 0 and 1, indicate the Start of a packet. The (E) bits D and F, indicate the End of packet. The (C) bit 2, indicates that the packet is a Control-packet if C-Bit=1, and the byte of data should be regarded as the message Length indicator. The (L or D) bits 3 to A, contain the Data packet byte. The (P) bit B, is used to provide Parity checking of the fifteen bits of the packet.

Each data packet will convey one of three data items;
Figure 5a represents a start-of-message packet.
Figure 5b represents a message data byte packet.
Figure 5c represents a end-of-message packet.

To fulfil the concept of the system, regarding the easily available local, hazard and route information, requires that transmitter units (10), are located on supports such as street lights, at convenient positions and/or prior to hazards along each road, as illustrated in Fig 6, Fig 7, Fig 8 and Fig.9. Any vehicle fitted with a suitable receiver device (20) and receiver unit (22) could then decode the transmitted message as explained previously.

Additionally, the means can be provided as mentioned previously, though not described here-in, such that the transmitter unit(s) could be linked by some means to a master controller which could then program the individual transmitters with special transport messages directly, for example but not exclusively such as warning drivers to exit the motorway at the next junction to avoid an accident on the carriageway.

Additionally, the means not described here-in could also be provided to link the transmitter(s) for example to a speed detector, that is either fixed or portable, and which could then be used by a police officer positioned on a motorway bridge, to inform drivers they should slow down or stop.

CLAIMS

1. A infra-red route and hazard system, for but not exclusively for motor vehicles, comprises of a usually fixed transmitter unit, with means to accept, store and continuously transmit by infra-red means, a variable length binary coded message, such that it can be received by a portable receiver, which comprises of the detector and a programable microprocessor receiver unit, mounted on a motor vehicle passing below the transmitter.

2. A infra-red route and hazard system as claimed in Claim 1, wherein the transmitter unit has means to enable it to be physically secured to and derive it's electrical power from the supporting structure.

3. A infra-red route and hazard system as claimed in any preceding claim, wherein the transmitter unit has means to enable it to transmit a binary coded message such that it contains information as to the location of the transmitter and also to any potential hazards further along the route of the traffic flow.

4. A infra-red route and hazard system as claimed in any preceding claim, wherein the receiver unit has means to enable it to receive and decode the infra-red message such that the message and inferred information as to the location of the transmitter and any potential hazards further along the route of the traffic flow, may be visually displayed to the driver of the vehicle.

5. A infra-red route and hazard system as claimed in any preceding claim, wherein the receiver unit has means to enable it to receive and decode the infra-red message such that the message and inferred information as to the location of the transmitter and any potential hazards further along the route of the traffic flow, may be imparted to the driver of the vehicle, in spoken English form.

6. A infra-red route and hazard system substantially as described herein with reference to Figures 1-9 of the accompanying drawings.

Pa[illegible]ts Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number: GB 9205570.6

Relevant Technical fields

(i) UK Cl (Edition L) G4Q (QAJ, QCE)

(ii) Int Cl (Edition 5) G08G

Search Examiner

M J DAVIS

Databases (see over)

(i) UK Patent Office

(ii)

Date of Search

24 FEBRUARY 1993

Documents considered relevant following a search in respect of claims 1-6

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2207792 A (WALE) Whole document	1-6
X	EP 0317181 A2 (PLESSEY OVERSEAS) Whole document	1-6
X	WO 87/06381 A1 (BALOUTCH) Whole document	1-6
X	US 4357593 A (VON TOMKEWITSCH) Whole document	1-6

Category	Identity of document and relevant passages	Relevant to claim(s)

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